Collaborative management of coastal zone programs

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The Challenge: In 2009 the issue in coastal zone sustainability is How do we change our behaviour? as opposed to Why change? or Change what? This is a challenge because ecosystem-based management requires effective collaboration across many government agencies at different levels, diverse civic groups, corporations, and land owners. Continuing declines in fish and bird populations, watershed health, and deteriorating coastal zones – despite our best intentions– prove how challenging it is to build and maintain multi-agency collaborative management.

People scattered across different agencies and different cities must collaborate, outside the support systems of their supporting government agencies, to:

- develop and implement their program's strategic plan;
- design and implement business processes for funding, integrating, and tracking internal and external projects;
- meet deadlines to disperse project funds, apply for funding, and report on progress relative to program goals; and accumulate and retain knowledge despite a turnover of key participants.

Communication, collaboration, knowledge management, and management logistics become as critical problems that threaten the outcome-based accountability required by funding agencies.

The Solution: This challenge is being met recently by creating independent programs to address regional sustainability, supported by government agencies. As examples, we compare the Newport Bay Watershed and Coastal Zone program in California with the Fraser Basin Salmon and Watersheds Program in British Columbia. Both programs seek to bridge the gap between science and management and to implement best practices such as adaptive management, outcomes logic models, and community engagement.

In our examples of multi-agency programs, they turned to web-based support systems to help their community of working groups to build and manage a strategic program, a knowledge repository, and performance reporting. We report on innovations they are pursuing to design new processes for implementing projects and to report on progress towards key sustainability outcomes that are shared across many scales and agencies.

Salmon biology, habitat conditions and assessment of stock abundance in the Kura River (Sakhalin Island)

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The objective of this study was to perform complex monitoring of salmon abundance and habitat and to reveal changes in abundance and biodiversity in Sakhalin rivers. Field observations and biostatistical data were obtained using standard methods. This included fry counts during downstream migration in the Kura River. Additionally, catch dynamics and biological characteristics of fish were studied during coastal fishing as well as spawning migration to rivers. Further, numbers of spawners on spawning grounds were estimated as well as survival during the embryonic life period. Fish species diversity in the river was evaluated based on seine catches and visual observations. About 15 fish species from 9 families were documented, all of which were either resident or anadromous. Pink salmon were the most abundant species. Natural (mainly climatic) conditions of this river affecting ichthyofaunal composition and abundance were revealed. The number and status of salmon spawning grounds in the Kura River were determined. In total, spawning grounds occupied 175.7 thousand m^2. Of them, one-fourth were occupied by masu salmon. At present, salmon stock abundance in Aniva Bay is at a high level, resulting in a mean catch of 19.7 million fish (3.5-47.4 million). Biological characteristics (length and sex ratio) of Pacific salmon species changed from early life stages through spawning migration, and depended on the ratio of fish from different stock groups. During 2004-2008, quantity of spawners on spawning grounds varied between 220,000-391,000 spawners (with an average of 294,200). The mean density was 167.5 spawners / 100 m^2 of spawning grounds (125- 223 spawners/100 m^2). Species composition of other fishes in the river basin was determined. Representatives of the genera *Salvelinus, Osmerus,* and *Tribolodon* were the most abundant.

Fluctuation of pink salmon (Oncorhynchus gorbuscha) *abundance in western and eastern Kamchatka at the brink of the XX and XXI centuries*

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The work represents results of the analysis of dynamics and spatial redistribution of pink salmon stock abundance in Kamchatka. In the "abundant" line (the even years) 1992-2006 in West Kamchatka the major commercial and production area in West Kamchatka was the Ust'-Bolsheretsky district; it provided about 75% on average of the total catch and up to 60% of adult escapement. In the "abundant" line (the odd years) 1993-2007 in East Kamchatka the major commercial and productive area was Karaginsky district; it provided about 90% on average of the total catch and approximately 60% of the total adult escapement in East Kamchatka.

Spatial redistribution of pink salmon catches has been revealed from the results of fishing campaigns such as those in the West and in East Kamchatka. Additional information may be collected in the future using trap nets set either in the south or the north part of one Kamchatkan coast. Meanwhile, the majority of stock abundance was changing from the south to the north on both the west and east coasts of Kamchatka for the entire observation period. The local stocks in both West and East Kamchatka could be affected unevenly as a result.

Kitwanga sockeye rebuilding

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Kitwanga sockeye are one of the 10 important Skeena River wild sockeye stocks. They are genetically unique and spatially separated from other Skeena sockeye populations. Historically, they numbered in the ten's of thousands per year. Today, average returns of less than 1,500 are observed, with only a few hundred fish returning in 3 out of the last 9 years. Presently, the stock is producing less than 5% of the potential for the system.

Kitwanga sockeye have been exposed to extremely high exploitation rates in most years (>50%) since the inception of commercial fishing at the mouth of the Skeena River in 1877. Freshwater habitats have also been adversely affected by forest development in and around the Kitwanga Watershed. Over exploitation and habitat destruction are believed to be the main factor contributing to the stock declines.

In the last ten years the Gitanyow First Nations People have implemented recovery strategies in hopes of rebuilding Kitwanga sockeye. Rebuilding efforts have focused on the accurate determination of smolt and adult production, the restoration of key lakeshore spawning areas and the production of fry through hatchery operations. Recovery strategies have yielded mixed results.

Nutrient and contaminant subsidies to an isolated northern Yukon ecosystem by spawning chum salmon (Oncorhynchus keta)

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Chum salmon *(Oncorhynchus keta)* return from the Bering Sea to the Fishing Branch of the Porcupine River to spawn in groundwater discharges from underlying karstic bedrock. Adults are enumerated at a counting fence and spawn in a 10 km long reach located upstream. The nearest significant chum spawning occurs 350 kilometers downstream. No industrial activity occurs upstream. Future disruption is unlikely as it is a Protected Area. The Yukon River watershed is sparsely populated with little development or disruption.

WWF Kamchatka salmon conservation initiative

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Wild Kamchatka salmon (Pacific salmon) is one of the 23 priority footprint-impacted species determined by World Wildlife Fund (WWF). In 2006, with support of the Gordon and Betty Moore Foundation, WWF launched an ambitious program on conservation and sustainable management of Kamchatka salmon. One of the greatest threats facing Kamchatka's salmon fishing industry today is illegal, unregulated and unreported fishing. High demand for Russian salmon products in the domestic and international markets, combined with low wholesale prices and inadequate management practices, drive Russian fishermen to engage in overfishing. WWF is working with fishermen, local communities, management agencies and international fisheries companies to introduce solutions to the Kamchatka salmon management problems. Our goals are:

(1) To substantially improve governance and management of salmon;
(2) To introduce market-based incentives to encourage sustainability;
(3) To increase enforcement and combat illegal fishing; and
(4) To promote and establish protected marine areas for salmon.

Global conservation of freshwater fishes: the role of the Freshwater Fish Specialist Group.

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The IUCN/WI Freshwater Fish Specialist Group (FFSG) is chaired by Professor Gordon McGregor Reid (Director General, Chester Zoo) and contains a diverse global network of 45 expert members, plus contact with a wider community of freshwater biodiversity conservation experts. Our vision is 'Freshwater fishes sustained in their natural environments'. As such, the group is concerned with conserving the aquatic environment worldwide and maintaining sustainable fisheries in relation to people and water resource use. Approximately 43% (12,000 species) of fishes occur in freshwater environments. As well making up a major part of global biodiversity, freshwater fishes are of major ecosystem, economic, scientific, social and cultural importance. In 2005 freshwater fishes represented approximately 27% of the world's annual fisheries and aquaculture production with a total of 38.5 million tonnes. Yet, freshwater fishes face a multitude of threats including overfishing, deforestation, natural system modifications such as dams and water management misuse, pollution, invasive species, unsustainable aquaculture and climate change. According to the IUCN Red List, approximately 43% of all freshwater fishes assessed to date are threatened. Indeed, the United Nations have forecast that 20% of freshwater fishes could go extinct within the next 30 years.

We are working together in a number of areas including strategy and policy development, provision of technical information and advice, training and education, Red Listing and biodiversity assessments. This is to tackle our biggest challenge: the development of a practical, global strategy for freshwater fish conservation in the face of species extinction and rapidly declining freshwater fisheries worldwide.

Chukotka salmon: modern status and climate influence

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Chukotka is a unique region for salmon due to an absence of hatchery fish stocks and low commercial catch rates. These factors make Chukotka an ideal place for developing management strategies for wild populations. However, the undeveloped nature of this fishery complicates data collection and forecasting.

Since the beginning of the 20th century until the present, the main assets of the Chukotka fishery are the Anadyr chum salmon and the sockeye from the Koryakian Coast reservoirs.

This work revealed that Anadyr chum abundance fluctuates in 40-year cycles, resulting partly from changes in biological productivity in the North Pacific. Chum numbers increased since the beginning of the 21st century. In 2008 however, a decrease in abundance has become apparent.

Forecasting salmon run timing precisely is critical, particularly considering the short length of the fishing season. Deviations from average run characteristics are due mainly to climatic factors. A delay of the chum run in 2007 resulted from a temperature anomaly in the Gulf of Anadyr.

Depending on fluctuations in abundance, stocks of Chukotka sockeye can be divided into two groups: those with 4-year cycles and those with 6-year cycles. Variations are caused by spawning in different climatic zones. Six-year cycles of increasing abundance are not often met in sockeye populations. Seemingly, they are typical of Chukotka stocks, which exist in the northern periphery of the study area.

Washington – British Columbia chapter of American Fisheries Society: come join us

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The WA-BC Chapter of the American Fisheries Society (AFS), which includes 800 members in Washington State and British Columbia, is a subunit of the world's oldest and largest organization of professional biologists interested in the scientific conservation and enhancement of fish populations and their environment. The Chapter actively promotes the advancement of fisheries science and the further education of fisheries professionals. Recently, the chapter has placed special emphasis on building opportunities for fisheries students by providing awards and travel grants. Our annual general meeting provides opportunities for regional fisheries scientists, managers, and stakeholders to share ideas about new research and management strategies. This year is no exception, with a dynamic program planned for April 20-23 in Shelton, WA. The WA-BC AFS conferences consistently support the mission of State of the Salmon by ensuring that the scientific basis of salmon management is always improving. Looking down the road, the Chapter will be hosting the American Fisheries Society Annual Meeting in September, 2011, with over 3,000 participants expected in Seattle. Watch for opportunities to participate in that conference. For more information about the chapter please visit www.npic-afs.org/.

If you are not already a member of AFS, you can join easily at www.fisheries.org/afs/.

The goals and principles of salmon conservation

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State of the Salmon has crafted an evolving "Goals and Principles for Salmon Conservation" as a living guidance document to help define the stewardship requirements for thriving wild salmon. These principles have been drawn from various current literature and salmon conservation policies.

Depleted populations could be lost forever, and the best wild salmon ecosystems could face unprecedented threats from climate change. While the exact approach to successful management will vary in locations around the Pacific Rim, the desired outcomes for robust populations and properly functioning salmon ecosystems are the same.

In order to develop more explicit guidelines that can be used to improve the effectiveness of salmon resource management/conservation approaches and actions, State of the Salmon plans to refine and elaborate on these goals and principles through collaboration with all interested partners and as informed by new fishery and conservation science.

State of the Salmon is inviting your participation by providing feedback on these conservation goals and principles at the February 2009 Conference and also by visiting our website at http://www.stateofthesalmon.org/about/principles.html and sending your review and comments to inquiries@stateofthesalmon.org.

Ghost runs: management and status assessment of Pacific Salmon returning to British Columbia's central and north coasts

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The management of Pacific salmon populations, which are spatially distributed across thousands of waterways in coastal British Columbia, Canada, presents considerable challenges to resource managers. We evaluated the efficacy of salmon management by Fisheries and Oceans Canada (DFO) over the past 55 years in two key areas: (i) the achievement of internally generated target escapement level and (ii) escapement monitoring. We show that less than 4% of monitored streams (n= 7 of 215), which represent a small fraction of all salmon bearing waterways (n=2592), have consistently met their targets since 1950. During this same period, the number of streams monitored by DFO has simultaneously decreased. Further, current monitoring efforts fall short of encompassing the range of salmon diversity identified within recently designated conservation units. Importantly, we found this erosion of monitoring effort has been biased toward dropping smaller runs that failed to meet their target escapements in the previous decade. We suggest that increasingly selective monitoring is presenting a progressively more biased evaluation of population health. In addition to fostering a "shifting baseline" syndrome, we conclude that these changes to monitoring cannot provide data required for precautionary harvest management under the high exploitation levels that these runs experience.

Pacific salmon conservation planning toolkit at multiple spatial scales

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The mission of the Wild Salmon Center is to identify, understand and protect the best wild salmon ecosystems of the Pacific Rim. In order to meet this mission, the Wild Salmon Center (WSC) is developing a decision support "toolkit" that addresses conservation planning and adaptive management for salmonids at multiple scales. The toolkit consists of databases and existing tools that are customized to the specifics of salmon conservation. At the Pacific Rim scale, WSC has the goal of developing an ecologically based conservation network design. We are using Marxan and the Pacific Salmon Conservation Assessment (PSCA) database to optimize the selection of a potential conservation network. At regional scales, we have finer-scale prioritization and monitoring needs. We are developing an expert opinion database for the Pacific Northwest region. We are also developing regional watershed condition monitoring protocols for the Kamchatka peninsula. At the individual basin scale, WSC has assessment and planning needs that are unique to individual basins. We are developing a set of tools that are flexible to meet needs of assessment, design, and monitoring. Each scale requires a different set of tools. This poster will highlight tools and approaches to prioritize conservation action across these scales and extents.

Current status of natural spawning of chum salmon populations in the Hidaka region, Hokkaido, Northern Japan

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To support a commercial fishery for chum salmon *(Oncorhynchus keta)*, intensive hatchery programs are conducted in Hokkaido, northern Japan; a total of about one billion hatchery-reared fish are stocked. It is believed that the majority of chum salmon returning to Japan are currently of hatchery-origin; however, information on naturally-spawning chum salmon is extremely lacking. We started a program to survey the status of naturally-spawning chum salmon populations in the Hidaka region, southern Hokkaido in 2006. All 25 rivers longer than 8 km were surveyed, and we observed chum salmon spawners or carcasses in 16 rivers. Of the 16 rivers where chum salmon were seen, hatchery-reared fish were recently stocked in 11 rivers, historically stocked in 2 rivers, and have never been stocked in 3 rivers. Many rivers in Hokkaido have been enhanced by hatchery programs, and therefore, naturally-spawning populations of chum salmon should be evaluated in consideration of the histories of hatchery programs. To conduct successful management for chum salmon stocks in Hokkaido, monitoring and conservation of naturally-spawning populations is inevitable, and in 2008, we started a new program to survey the status of naturally-spawning chum salmon populations in the entire island of Hokkaido.

Fraser Salmon and Watersheds Program

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With a vision of "healthy salmon populations in functioning watersheds co-existing with thriving communities in the Fraser Basin," the Fraser Salmon & Watersheds Program (FSWP) was created by the Pacific Salmon Foundation (PSF) and Fraser Basin Council (FBC) in conjunction with the Living Rivers Trust Fund and DFO's Fraser Basin Initiative. Acting as neutral third parties, PSF and FBC work with a variety of perspectives, both on-the-ground groups and top-down larger institutions, to address complex challenges.

The mission of FSWP is to "inspire changes in human behaviour for the benefit of salmonids and the watersheds on which we all depend." FSWP is charged with creating and coordinating an adaptive strategy for pursuing this mission in the face of such challenges as climate change, development pressures and fisheries access and allocation. FSWP functions through ongoing collaboration to identify, scope, implement, and fund priority activities in four program areas: Habitat, Governance, Fisheries, and Engagement. The program seeks to engage First Nations and their world views in all four areas. FSWP actively seeks partners to collaborate on this exciting work.

Activities to rehabilitate and conserve river ecosystems in dairy producing areas together with local communities and local NGOs

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Hamanaka-cho, which is located in the eastern part of Hokkaido, is one of the largest dairy producing areas in Japan. Since the 1960s, the river ecosystems in this area have been damaged due to large-scale pasture development. In recent years, however, dairy farmers have been shifting their focus to an "emphasis on sustainability," and a project to rehabilitate river-side forests was started in 2001 to improve water quality and restore biodiversity.

In October 2008, as part of this project, the local community of dairy farmers took the lead in building a fish passage in a diversion weir to help fish run up river, with the objective of protecting fish such as Ito and cherry salmon that breed in the wild.

Kiritappu Wetland Trust, a local NGO, played an important role in creating a network among local residents and coordinating with related institutions. The NGO Hokkaido Freshwater Fish Conservation Network supported the project to create the fish passage and held study sessions to educate the community on the significance of conserving and rehabilitating river ecosystems. As a result of such activities, local dairy farmers in conjunction with the two NGOs persuaded the government to revise the river development construction, which would have negatively affected the spawning of wild pink salmon, and succeeded in protecting the natural spawning habitat.

Community conservation strategies to protect the future of sacred salmon A solutions-based poster outlining a timeline of successful action items, and what exactly is at stake

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Three of the West Coast's most important salmon and steelhead-bearing watersheds - The Sacred Headwaters – have temporarily been protected from ecological and social havoc after a hard won campaign. This poster will outline why this community-based conservation approach worked and how others can learn from the model.

The Sacred Headwaters is a vast wilderness area in the North West of Canada, home to three great salmon river watersheds: Stikine, Skeena and the Nass. Distressingly the 700,0000 hectares, sometimes called the Serengeti of Canada is also the next site for Royal Dutch Shell to sink its drill bits for coal bed methane – one of the most destructive forms of resource extraction.

Local groups and spokespeople have made such valiant efforts to rally support and spread awareness that the BC Government announced a two-year moratorium on coalbed methane drilling in the Sacred Headwaters. This is an example of sound government for decision- making and the results of passionate residents who had the courage to stand up for their homes.

The successful grassroots approach towards ensuring sustainable salmon habitat is worth studying along with the economic pressures that continue to threaten the watershed.

Lessons learned from regional monitoring: project level effectiveness monitoring for habitat restoration in the Pacific Northwest

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The Washington State Salmon Recovery Funding Board (SRFB) was created by the state legislature in 1999. Since then, the SRFB has funded more than 963 salmon habitat projects, spending more than $358 million in state and federal funds. In 2004, the SRFB created the Reach-Scale Effectiveness Monitoring Program to track effectiveness of implemented projects. A regional effectiveness monitoring program with the Oregon Watershed Enhancement Board (OWEB) was implemented in 2007, representing a coordinated approach to effectiveness monitoring, data sharing, and cost control.

The SRFB program includes nine monitoring categories that group projects according to project objectives and methods. The intent of the monitoring is to test whether habitat outcomes targeted by restoration actions have been achieved, and for some categories, whether local salmon and steelhead abundance has increased.

Current results show that Fish Passage Projects are increasing adult coho densities; In-Stream Structure Projects are improving geomorphology; Livestock Exclusion Projects are decreasing bank erosion, and Channel Connectivity Projects are increasing mean vertical pool profile area and mean residual depth. Indications of change need to be viewed within the context of the project and the longer-term perspective that will be developed over the life of the monitoring program.

Let's hand down a river where you can fish wild Ito forever

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Sarufutsu Ito-no-Kai, founded in April 2005 when it took over the "Home-of-Ito Project" from the Sarufutsu Chamber of Commerce Youth Division, conducts community-based activities in Sarufutsu, a village located at the northernmost tip of Japan, using the Ito *(Hucho perryi)*, the largest freshwater salmon species in Japan, as an environmental indicator. Our slogan is "Let's hand down a river where you can fish wild Ito forever," and we strive to realize the mutual co-existence of humans, industry, and the natural environment.

The Association's main activities include investigating spawning beds during spawning season, projecting Ito numbers in each river, checking reproduction conditions for each tributary, and monitoring the hatched fry status, while cooperating and exchanging information with Ito researchers and fishermen. In addition to such investigations, we have been able to build fish passages in two locations by petitioning the local government.

From the perspective of community development, we work as a pipeline between the community and the local government and engage in activities to maintain the current environment such as study sessions with the local government. We cooperate with forest owners and landowners in achieving our objective of realizing an environment habitable to Ito and a diverse community of nature, living creatures, and humans. We will continue to teach children the joy of fishing the great Ito in the rivers that flow through Sarufutsu, and to learn together the importance of an environment inhabited by Ito.

Modelling the effects of climate change on migratory success of Fraser River sockeye salmon

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Fraser River water temperature and flow exposure strongly influence the probability of survival for migrating sockeye salmon. Climate change models forecast increasing summer river temperature, and shifts towards earlier timing and changes to the distribution of the peak freshet. Evidence of species and stock-specific tolerances to environmental thresholds suggest that different populations of Pacific salmon will not respond equally to the common change in Fraser River environmental conditions. Development of models for predicting the probability of fish survival under different river temperature and flow scenarios will be essential for understanding the potential effect of climate change on migration success. We explore two alternative approaches to modelling the relationship between river environment and fish survival: (1) modelling migration barriers as a function of aerobic scope and (2) fitting logistic mixed effect models to survival data from radio tagging studies of Fraser River sockeye in combination with reconstructed temperature profiles. Given the uncertainty with respect to both future climate trends and fish responses to the river environment, comparable results from a variety of model applications will provide supporting evidence for the anticipated effects of climate change on ultimate spawning success.

Collaborative fish screen design on crabtree creek in Linn County, Oregon

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Irrigation and hydro-power diversions are common on most rivers and streams in the Pacific Northwest. In Oregon alone, there are 60,000 - 70,000 diversions and only about 10% of those have fish screens on them. Designs that satisfy both diverters and agencies can be difficult to achieve.

Lacomb Irrigation District operates a combined irrigation and hydro-power diversion on Crabtree Creek, a tributary to the Santiam River in Oregon. The diversion had a large settling basin followed by a rotary drum screen that no longer met criteria and that required constant maintenance. In late 2005, representatives of the following organizations met to begin a collaborative design process to replace the fish screen: Oregon Department of Fish and Wildlife, US Fish and Wildlife, National Marine Fisheries Service, Lacomb Irrigation District, and Farmers Conservation Alliance.

The new fish screening structure was designed to protect all species present (including salmonids) while minimizing operation and maintenance issues. The chosen screen design had to accommodate a very wide flow range (18 CFS to 65 CFS) and a high organic debris load. A horizontal Farmers Screen became the chosen technology. The project was successful for both Lacomb Irrigation District and the agency partners involved.

Managing for climate effects across latitudes

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Climate change and future water management will alter many aspects of Pacific salmon habitat including food webs, flow regimes, water temperature and quality, pathogens, ocean productivity, and land cover. However, anticipated habitat changes and salmon life histories vary greatly across the geographic range. Locally adapted populations may display variable responses in abundance based on current limiting factors, and likelihood of exposure to physiologically limiting conditions.

We framed our investigation within a comparison of four interior basin tributaries across the latitudinal distribution of spring-run Chinook. At each site, our mechanistic life cycle model was parameterized to represent spatially realistic functional relationships between stage-specific survival and temperature, flow, and other ocean and habitat variables. Density-dependence was imposed for early life history stages, and habitat capacity was inferred both from intrinsic potential analyses and escapement and smolt studies. Population dynamics under potential future scenarios of climate change were simulated with temperature, and tributary flow data downscaled for watersheds by the Climate Impacts Group at University of Washington. Restoration and water management options contributing to population resilience were explored. Here, we present initial results from the upper Columbia River and the Butte and Mill Creek tributaries.

Prespawning mortality of fall chum salmon

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In 2008, mass mortality of fall chum salmon occurred in the Amur River drainage. Of 350 million chum in the population, about 1 million dead fish were estimated. Dead fish had no spawning color and their gonads were in stage IV of maturity. Their swim bladders were holding gas and they were floating on the water surface. The rivers banks were covered by dead fall chum salmon. Mass mortality occurred in spawning tributaries, where the water temperature was lower and the oxygen content was higher than in the Amur channel. Dead fish of other species were not observed. Analysis of dead fish revealed the focal affection of gill filaments caused by a conditionally pathogenic fungi of the genus *Branchiomyces*. Usually, the spawning run of fall chum salmon into the Amur River begins between August 26th and 31st. In 2008, however, chum salmon entered the Amur River ten days earlier than usual at a low water level and a water temperature of more than 20°C. Such hydraulic conditions were a stressing factor which caused the lower defenses in fish and the resulting gill infection. *Branchiomyces* occur in water enriched by organic matters and at water temperatures of 22° to 23° C. Prespawning mortality of fish ended when the water level increased and water temperature decreased.

Salmon sustainability lens: volunteer community Knowledge Transfer (KT) is making a difference for salmon in the wild

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Knowledge Transfer, synthesis and exchange, amongst individual volunteers, stewardship groups, and communities is influencing personal values, developing community leaders, and creating political will. In British Columbia, volunteers through their body of salmon and habitat projects that engage local peoples are making a substantive and sustainable difference for salmon.

Any particular group of projects may be criticized as a patchwork of isolated activities, but each project attracts additional volunteers and builds a positive and expanding initiative. This outcome may provide the real sustainable benefit to salmon: increased public awareness, behaviour change to reduce individuals' impacts on salmon and habitat, and recognition of salmon as a personal and public value.

Those influenced to give of their time and/or money begin to think about salmon differently. By analogy, over time they create a salmon sustainability "Lens;" a way to behave in local communities to live with salmon now and in the future.

The PSF's independent Salmon Program evaluation is charting the development of a Salmon Sustainability Lens: people making different choices, attending city council meetings and participating in consultative processes to represent salmon, increasing awareness of local impacts, and building political will. Change takes time but the benefits from community volunteers are growing and increasingly apparent.

Retrospective assessment of the direct genetic impacts of escaped farm salmon on a wild Scottish stock

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The potential exists for negative impacts on wild salmon populations *(Salmo salar)* from interbreeding with escaped farm salmon but its actual extent remains uncertain and controversial. Information on numbers of escapes and gene introgression are generally lacking, in part due to a lack of historical baseline information. To address this information gap, a molecular genetic study was carried out of impacts in the Loch na Thull catchment, a small river system in northwest Scotland with a small wild stock and subject to freshwater cage rearing of farm smolts from 1997-2004 with the documented presence of escapes. The study was opportunistic and based on an eclectic set of DNA sources and genetic data that precluded a simple before and after comparison. However, though significant genetic differences were found between wild and farm salmon, the study found that the farm salmon appeared to contribute little to the genetic character of the current wild stock through interbreeding and introgression. The study cannot say whether ecological interactions with farm escapes such as competition for food and space or increased pathogen transfers, may have led to indirect genetic impacts (e.g. loss of genetic variability), due to increased mortality and smaller numbers of returning spawners.